2. Planar Optode: A so called planar optode has been used to obtain the oxygenconcentration in two dimensions in the sediment and at the sediment-water interface. A planar optode is like an "inverted periscope" which is gently inserted into the sediment. Through a special optical technique, called luminescence quenching, it is possible to obtain high resolution oxygen images. From the oxygen images oxygen concentration gradients (profiles) can be extracted. About 600 oxygen profiles can be extracted from each image and from the profiles the sediment oxygen consumption can be calculated, which gives an independent estimate of carbon turnover rates.

3. Oxygen gradients in the water: Oxygen optodes have been mounted at different levelsin the water column. These sensors reveal the dynamism of the aquatic environmentand it is possible to extract gradients with lower concentrations for example closer to the bottom and higher close to layers with active primary production. Together with information about the currents we have developed methods that can be used calculate the oxygen consumption/production in different layers.

CUMAS
CABLED UNDERWATER MODULE FOR ACQUISITION OF SEISMOLOGICAL DARA FOR GEO-HAZARD MONITORING IN SHALLOW WATER

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1. Introduction

CUMAS is an underwater module developed for the acquisition of geophysical signals in shallow seafloor for geohazard monitoring in volcanic areas. It was conceived for a specific application in the Campi Flegrei Caldera (Southern Italy) where the main features of the present volcanic activity consists of slow soil movements (bradyseism) accompanied by intense and shallow seismic activity. The latest strong episode occurred in the period 1982-84 with a ground uplift of more than 170 cm followed by a slow and continuous subsidence still ongoing with of small amplitude uplift episodes (few centimeters). It is worth noting that the seismic activity only appears during the uplift phase.

CUMAS is the first step toward the extension of the present operating land-based monitoring networks of the Campi Flegrei in the marine sector of the Caldera, roughly covering more than one third of the volcanic area.

2. CUMAS features and functionalities

CUMAS has the aim to
-continuously acquire on the seafloor geophysical and oceano graphic data according to a single time reference;
-transmit acquired data in real time to a acquisition centre on land;
-receive commands from the land centre and accordingly modify its acquisition configuration.

CUMAS is powered through a cable connecting the module to a surface infrastructure; this ensure a long lasting deployment on the seafloor.

All these features make CUMAS fully integrated in centralised monitoring system of the Neapolitan volcanic areas (Vesuvio, Campi Flegrei and Ischia Island) managed by Osservatorio Vesuviano-INGV.

CUMAS consists of a frame of steel with a shape of truncated pyramid of about 1 m high and a square base of 1 m per side. The total weight including the equipment is about 430 kg in air.
In the CUMAS frame the following sensor packages are installed:

1. seismological sensors aimed at recording local earthquakes related to volcanic activity and artificial explosions often caused by fishermen; the sensors include
-a three component broad band seismometer (0.025 s - 40 s) Guralp CMG-40T OBS with auto-levelling platform
- a broad band hydrophone (1 Hz – 65kHz) Sensor Technology SQ03 model

2. physical oceanographic sensors are aimed at the long-term monitoring of the water current regime also useful for seafloor seismic microtremor studies; a further task consists in testing the feasibility of the use of water pressure measurements at seafloor to detect changes in water column pressure potentially related to bradiseismic activity. The oceanographic sensors include
-a single point three component acoustic current meter 3D-ACM Falmouth
-a pressure gauge Series 8000 Paroscientific.

Data acquisition in performed by a Quanterra Q330 digitiser equipped with external hard disk as local mass storage. The digitiser is installed inside a cylindrical aluminium vessel and it is used to acquire the seismological sensors, both sampled at 125 sps.

The data acquistion analog sensors and data acquisition embedded computer for sensors with digital output. The physical-oceanographic sensors with digital output are acquired by an embedded computer with Linux o.s.
Further sensors installed in the vessel are acquired by the Linux PC, namely tilt and heading sensors, for the measure of the real module attitude on the seafloor, and status sensors for the monitoring of the internal status of the vessel (e.g., internal temperature, power absorption, water intrusion).

Both acquisition systems are linked via Ethernet cable to a router connected to an electro-mechanical cable for the real time data transmission to the sea surface. A Wi-Fi communication system ensures the seafloor data transfer to the land acquisition centre in the city of Naples.

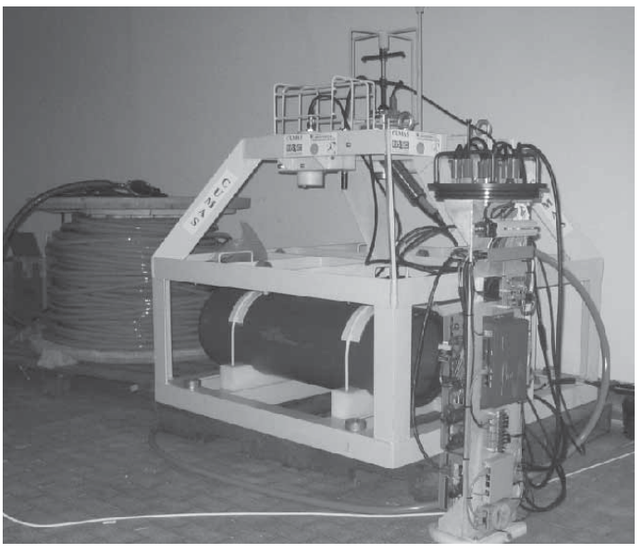

Figure 1. CUMAS fully equipped in lab during tests; the acquisition system and the seismic sensor were temporary kept out of the frame to check the operation.

3. Deployment and operation

CUMAS has been developed to be installed in the sea sector of the Campi Flegrei Caldera at 97 m w.d., from 2 to 3 km far from shore and about 4 km far from the acquisition land centre.

A buoy (elastic beacon), previously deployed and presently operating, is used as the support infrastructure for CUMAS. The buoy, 8 m high above the sea level, is equipped with batteries charged by solar panels and aeolic generator. A CISCO bridge, equipped with omnidirectional antenna, allows the data transmission to land.

A meteo station is also mounted on the buoy providing the local meteo measurements (e.g., barometric pressure, wind velocity and direction, rain-meter, thermometer) to allow correlation of the air and seafloor data.

The deployment of CUMAS is performed by lowering the module in the sea water by means of its own electro-mechanical cable with the support of a ship equipped with a crane. Once the module is on the seafloor, the cable is deployed on the seafloor too and its end is connected to a junction box installed on the top of the buoy.

The CUMAS operation on the seafloor is planned to be at least 1 year long.

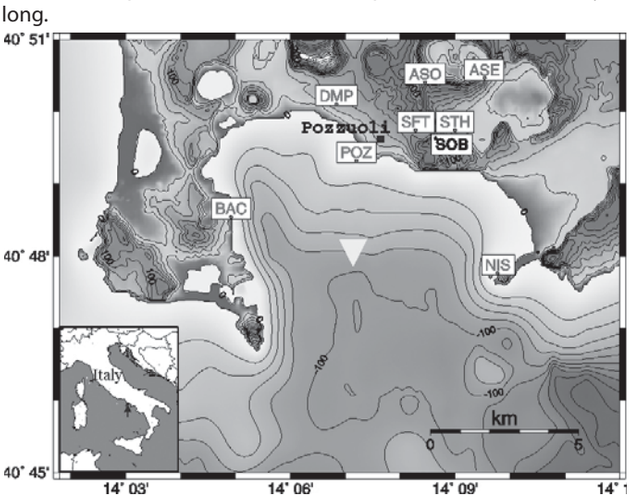

Figure 2. The Gulf of Pozzuoli (west of Naples) and the site (yellow triangle) selected for the deployment of CUMAS.

4. Expected results

CUMAS represents the first marine node of a land-sea integrated network for geo-hazard monitoring. Its data, continuously sent to the land acquisition center, will be integrated with those belonging to the whole surveillance system. In particular the seismological data will be used jointly with the land seismic network and contribute to improve the location of the earthquakes occurring in the sea sector of the Caldera. Furthermore, as demonstrated by Vassallo et al. [1] this use will enhance the seismic detection capability of low energy earthquakes usually masked by the high level anthropic seismic noise typical of densely populated areas.
The pressure gauge measurements, corrected for tidal effect and complemented with coastal tide gauge network data, can for the first time estimate vertical seafloor bradiseismic movement, till now measured only on land.

5. References

[1] Vassallo M., Bobbio A. and Iannaccone G., Analysis of broad band seismic data acquired under the sea of Pozzuoli Gulf (Southern Italy), European Geophysical Union General Assembly, Wien, 2006.

REAL TIME TRANSMISSOIN OF CURRENT AND TURBIDITY DATA FROM THE NEAR BOTTOM VAR CANYON SYSTEM

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1. Introduction

Under the umbrella of the EU-FP6 HERMES program, Ifremer is committed in the monitoring of the particle dynamics in the Var canyon. For this purpose, several seabed measurement stations with a near-real time link to shore were installed, enabling the monitoring of the Var Valley from Brest. Two currentmeters and one fluorometry and turbidity sensor, installed on the levee of the valley at a depth of 2000 metres, send their measurement data every six hours to shore. The paper describes the measurement and data transmission system, its functioning and the main lessons learnt along two years of implementation.

2. System description, Results and Discussion

Among the various measurement stations and moorings installed in the Var Canyon [1] two stations were fitted with the SEAMON technology developed during the EU-FP5 ASSEM project [2]. This technology enables the measurement data from various local deep sea sensors to be collected as and when generated, then periodically forwarded to a data base on shore. MAP3 (currentmeter, fluorometer and turbidity sensor near the seabed) and SSB (currentmeter) stations benefited from this service. The near real-time link comprises one acoustic segment between each seafloor station and a relay-buoy, followed by an Iridium satellite segment joining the buoy to a shore server. The link is bi-directional, allowing the modification of the measurement parameters at any time, by an operator on shore.